

REMARKS

This is a full and timely response to the outstanding Final Office Action mailed April 23, 2004. Upon entry of this response, claims 1-51 remain pending in the present application.

In the Office Action, pending claims 1, 2, 4-6, 22-24, and 27-36 have been preliminarily rejected for anticipation under 35 U.S.C. § 102 and claims 3, 7-34, 37, 42, and 46-51 have been preliminarily rejected for obviousness under 35 U.S.C. § 103(a). Claims 12, 20, and 25 have been objected to as containing contradictory language. The Applicants traverse all of the rejections of the Office Action. Reconsideration and allowance of the subject application and presently pending claims 1-51 is respectfully requested.

I. Claim Objections

The Examiner objected to claims 12, 20, and 25 because the claims "say the shaft is one thing and then say the shaft is the opposite." Specifically, each of the claims states that the "output shaft is an input shaft." Arguably this language could be interpreted to suggest, under this limitation, that the output shaft ceases to provide output and only provides input, which would violate the requirement under patent law that dependent claims narrow and do not broaden the limitations of the depended upon claims. The apparent contradiction of the original language has been corrected by amendment, such that each claim states the "output shaft is additionally an input shaft", as suggested by the Examiner.

The Applicants respectfully request the Examiner withdraw the present objection.

II. Response To Claim Rejections Based On Anticipation

In the Office Action, claims 1, 2, and 4-6 have been rejected based on 35 U.S.C. 102 as being anticipated by Japanese Reference 62221856 A (hereafter the "Japanese Reference"). Claims 22-24 and 27-36 have been rejected based on 35 U.S.C. 102 as being anticipated by U.S. Patent No. 4,719,381 to Miles (hereafter "Miles").

As the examiner is aware, "Anticipation can only be established by a single prior art reference which discloses each and every element of the claimed invention." *Structural Rubber Products Co. v. Park Rubber Co.*, 749 F.2d 707, 223 USPQ 1264 (Fed. Cir. 1984). Further, "Absence from a cited reference of any element of a claim of a patent negates anticipation of that claim by the reference." *Kloster Speed Steel AB v. Crucible, Inc.*, 793 F.2d 1565, 230 USPQ 81 (Fed. Cir. 1986), *on rehearing*, 231 USPQ 160 (Fed. Cir. 1986). Thus, even if a single element found in Applicants' claim is not identically and exactly disclosed in prior art relied upon by the Examiner, the Examiner's rejection of the claims under 35 U.S.C. 102(b) is improper.

Applicants respectfully submit that the Japanese Reference and the Miles reference fail to teach, disclose, or suggest all elements of the rejected claims for the reasons that follow.

A. Claim 1

Independent Claim 1 presently reads:

A motor having an output shaft movable in multiple degrees of freedom, the motor comprising:  
a stator having an interior curved surface;

a first stator coil and a second stator coil wound in close proximity to the interior surface, but not extending inward of the interior curved surface, the first stator coil and the second stator coil positioned substantially orthogonally to each other; and

a rotor fixed to the output shaft and movably supported adjacent the interior surface of the stator with an air gap disposed between the rotor and the stator, the rotor including ***at least one magnet disposed thereon and being movable along the interior surface*** in directions defining at least a first and a second degree of freedom; ***wherein upon energization of the first stator coil a first magnetic field is established to urge the rotor to rotate in a direction of the first degree of freedom, and upon energization of the second stator coil a second magnetic field is established to urge the rotor to rotate in a direction of the second degree of freedom, the second degree of freedom substantially perpendicular to the first degree of freedom.***

***(Emphasis Added).***

The Examiner preliminarily rejected claim 1 based on 35 U.S.C. 102 as being anticipated by the Japanese Reference. The Examiner states in the office action, the Japanese Reference discloses a motor with an output shaft, a stator with a curved interior surface having first and second coils 7c+, 4c+, a rotor with magnets for movement in at least two degrees of freedom. The Applicants respectfully disagree with the Examiner's analysis. If 7c+ is the first stator coil and 4c+ is a second stator coil, the Applicants do not believe energization of 7c+ will urge the rotor to rotate in a direction substantially perpendicular to a direction of rotation urged by energization of 4c+. The Applicants believe that, while the rotor in the Japanese Reference has multiple degrees of freedom of motion, these coils will only urge the rotor along one axis, specifically rotationally about the Z-axis. The Applicants respectfully request the Examiner review this limitation again, specifically analyzing the direction of rotation of the rotor after energization of 7c+ in comparison to the direction of rotation of the rotor after energization of 4c+.

HAYES SOLOWAY P.C.  
130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

Claim 1 also is limited to "at least one magnet disposed [on the rotor] and being moveable along the interior surface", which the Japanese Reference does not disclose. The Japanese Reference moves a magnet within the interior of the stator, but not along an interior surface of the stator. Anticipation can only be established by a single prior art reference that discloses each and every element of the claimed invention.

As the Japanese Reference fails to disclose each and every limitation of claim 1, the Applicants respectfully request the Examiner withdraw the anticipation rejection.

B. Claims 2 and 4-6

The Applicants respectfully submit that since claims 2 and 4-6 depend on independent claim 1, claims 2 and 4-6 contain all limitations of independent claim 1. Since independent claim 1 should be allowed, as argued above, pending dependent claims 2 and 4-6 should be allowed as a matter of law for at least this reason. In re Fine, 5 USPQ 2d 1596, 1608 (Fed. Cir. 1988).

C. Claim 22

Claim 22 presently reads:

A motor having an output shaft movable in multiple degrees of freedom, the motor comprising:

a first stator, the first stator having an interior curved surface and a first stator coil, a second stator coil, and a third stator coil, the stator coils wound in close proximity to the interior surface;

a second stator, the second stator having an interior curved surface and a fourth stator coil, a fifth stator coil, and a sixth stator coil, the stator coils wound in close proximity to the interior surface;

HAYES SOLOWAY P.C.

130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

a commutation system capable of changing the distribution of current in the first, second, third, fourth, fifth, and sixth coils to provide a desired force at each output shaft position; and

a rotor fixed to the output shaft and movably supported adjacent the first stator and the second stator with an air gap disposed between the rotor and the stators, the rotor including at least one magnet disposed thereon and being movable along the interior surfaces in directions defining at least first, second, and third degrees of freedom, ***each degree of freedom substantially perpendicular to the other degrees of freedom, wherein energization of at least one of the stator coils is capable of urging the rotor along any of the degrees of freedom.***

***(Emphasis added).***

The Examiner preliminarily rejected claim 22 based on 35 USC 102 as being anticipated by Miles. The Examiner alleges in the office action that Miles discloses a motor having an output shaft 31, a first stator S1, a second stator S3, each having first, second, and third coils as described in column 4, lines 36-45, and each having an interior curved surface, a commutation system for changing the distribution of the current in the coils as described in column 6, lines 16-25, a rotor R, and at least one magnet on the rotor as described in column 4, lines 19-23, with the magnet being an electromagnet.

The Applicants have herein amended claim 22 to include the emphasized limitation. Specifically, Miles teaches a stator and rotor arrangement capable of urging the rotor in only two degrees of freedom. As shown in FIG. 3 and FIG. 4 of Miles, the rotor may be urged to rotate about axis 33 in FIG. 3 and about axis 37 in FIG. 4 (axis 37 is shown in FIG. 3 and imputed to FIG. 4 herein), wherein axes 33 and 37 are believed to be substantially perpendicular to each other. The arrangement of the stators and the slots on the rotor show that stators S1 and S2 control one degree of freedom and stators S3 and S4 control the other degree of

freedom. However, neither stator pair can urge the rotor along a third degree of freedom, as the Applicants have claimed.

As Miles fails to disclose each and every limitation of claim 22, the Applicants respectfully request the Examiner withdraw the anticipation rejection.

D. Claims 23, 24 and 27-34

The Applicants respectfully submit that since claims 23, 24, and 27-34 depend on independent claim 22, claims 23, 24, and 27-34 contain all of the limitations of independent claim 22. Since independent claim 22 should be allowed, as argued above, pending dependent claims 23, 24, and 27-34 should be allowed as a matter of law for at least this reason. In re Fine, 5 USPQ 2d 1596, 1608 (Fed. Cir. 1988).

1. Claim 29

Claim 29 reads:

The motor of claim 28, wherein all of the parallel slots are perpendicular to a longitudinal axis of the output shaft when the output shaft is in a neutral position.

In Miles, the parallel slots shown in FIG. 3 are parallel to a longitudinal axis of the output shaft when the output shaft is in a neutral position. As Miles fails to disclose each and every limitation of claim 29, as amended, the Applicants respectfully request the Examiner withdraw the anticipation rejection.

E. Claim 35

Claim 35, as amended herein, reads:

A lamination for use in a stator, comprising:  
a ferromagnetic material ***having an arcuate surface;***

a first side surface orthogonal to the arcuate surface;  
 a second side surface orthogonal to the arcuate surface and  
 opposite the first side surface; and  
***a plurality of parallel slots extending from the first side  
 surface to the second side surface through the arcuate surface.***

***(Emphasis added).***

The Examiner preliminarily rejected claim 35 based on 35 U.S.C. 102 as being anticipated by Miles. The Examiner alleges in the office action that Miles discloses laminations with an arcuate surface orthogonal to a first side surface and having a plurality of slots as shown in Figure 3 and as described in column 4, lines 55-58. The Applicants have amended claim 35 to clarify the location of the claimed arcuate surface, which can be best seen in FIG. 15c of the application, marked as I<sub>s</sub>. Nothing in Figure 3 of Miles teaches, discloses, or suggests any individual lamination sheets have the claimed arcuate surface. Column 4, lines 55-58, of Miles states the stator blocks are made of laminations of magnetically permeable material, but it does not teach, disclose, or suggest any surface of the laminations are arcuate. Further, methods of making stator surfaces arcuate are not known in the art. The Applicants, therefore, would also suggest that FIG. 3 of Miles is simply a general impression of an interior shape of the stator, which is not arcuate in practice. Miles fails to disclose an arcuate surface on a lamination as claimed. Anticipation can only be established by a single prior art reference that discloses each and every element of the claimed invention.

As Miles fails to disclose each and every limitation of claim 35, the Applicants respectfully request the Examiner withdraw the anticipation rejection.

F. Claim 36

HAYES SOLOWAY P.C.  
 130 W. CUSHING ST.  
 TUCSON, AZ 85701  
 TEL. 520.882.7623  
 FAX. 520.882.7643

175 CANAL STREET  
 MANCHESTER, NH 03101  
 TEL. 603.668.1400  
 FAX. 603.668.8567

The Applicants respectfully submit that since claim 36 depends on independent claim 35, claim 36 contains all of the limitations of independent claim 35. Since independent claim 35 should be allowed, as argued above, pending dependent claims 36 should be allowed as a matter of law for at least this reason. In re Fine, 5 USPQ 2d 1596, 1608 (Fed. Cir. 1988).

### III. Response To Claim Rejections Based On Obviousness

In the Office Action, claims 3, 10, 11, 14-16, and 18 have been preliminarily rejected under 35 U.S.C. §103(a) as being unpatentable over the Japanese Reference in view of U.S. Patent No. 4,908,558 to Lordo (hereinafter "Lordo"); claims 12, 13, 20, and 21 have been preliminarily rejected under 35 U.S.C. §103(a) as being unpatentable over the Japanese Reference in view of U.S. Patent No. 6,004,134 to Marcus et al. (hereinafter "Marcus"); claims 17 and 19 have been preliminarily rejected under 35 U.S.C. §103(a) as being unpatentable over the Japanese Reference as modified by Lordo and further in view of U.S. Patent No. 5,382,860 to Fanning et al. (hereinafter "Fanning"); claims 22-24, 27, and 30-34 have been preliminarily rejected under 35 U.S.C. §103(a) as being unpatentable over the Japanese Reference in view of by Lordo and further in view of U.S. Patent No. 5,196,745 to Trumper (hereinafter "Trumper"); claims 25, 26, and 46-51 have been preliminarily rejected under 35 U.S.C. §103(a) as being unpatentable over the Japanese Reference in view of by Lordo and further in view of Trumper and further in view of Marcus; claims 25 and 26 have been preliminarily rejected under 35 U.S.C. §103(a) as being unpatentable over Miles in view of Marcus; claim 37 has been preliminarily rejected under 35 U.S.C. §103(a) as being unpatentable over Miles in

HAYES SOLOWAY P.C.  
130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567



view of Fanning; and claim 42 has been preliminarily rejected under 35 U.S.C. §103(a) as being unpatentable over Lordo in view of the Japanese Reference. It is well established at law that, for a proper rejection of a claim under 35 U.S.C. §103 as being obvious based upon a combination of references, the cited combination of references must teach, disclose, or suggest, either implicitly or explicitly, all elements/features/steps of the claim at issue. See, e.g., In re Dow Chemical, 5 USPQ 2d 1529, 1531 (Fed. Cir. 1988), and In re Keller, 208 USPQ 871, 881 (CCPA 1981).

Therefore, if the Examiner intends to maintain the obviousness rejections, based upon a combination of prior art references, the Applicants respectfully request that the Examiner locate references that, combined, teach, disclose, or suggest all limitations of the Applicants' claimed invention.

A. Claim 3

Dependent claim 3 reads:

The motor of claim 1, wherein ***the curved interior surface is defined by a stator back iron*** comprising a ferromagnetic material.

***(Emphasis Added)***

The Applicants respectfully submit that the Japanese Reference in view of Lordo, fails to teach, disclose, or suggest at least the above-emphasized element of claim 3.

Specifically, the Japanese Reference in view of Lordo fails to at least teach, disclose, or suggest that the curved interior surface is defined by a stator back iron. The Examiner admitted the Japanese Reference fails to disclose a stator back iron. The Examiner suggests that Lordo at column 6, lines 43-46, discloses a back iron.

Column 6, lines 43-46, of Lordo states, "As shown in FIG. 6, winding elements 114 and 116 are bonded to the surface of a flux carrying element 118 which is part of the stator." Nothing in Lordo teaches, discloses, or suggests windings 114 and 116, which may be along the interior surface, operate as a back iron, to focus the field into the gap between the rotor and the stator. Indeed, windings would not be used as a back iron. Flux carrying element 118 is operating as a back iron, but is not defining the curved interior surface, as the Applicants have claimed. The Examiner further states that "it would have been obvious at the time the invention was made for one of ordinary skill in the art to have utilized a back iron in the Japanese Reference motor in order to reduce flux losses and thus improve efficiency of the motor." However, the Examiner does not explain how Lordo could have been used to modify the Japanese Reference to define the curved interior surface with a back iron, when Lordo does not teach, disclose, or suggest defining a curved interior surface with a back iron. A proper rejection of a claim under 35 U.S.C. §103 as being obvious based upon a combination of references, requires the cited combination of references must teach, disclose, or suggest, either implicitly or explicitly, all elements/features/steps of the claim at issue. As there is no teaching, disclosure, or suggestion in either the Japanese Reference or in Lordo to use a back iron to define a curved interior surface and produce the claimed invention, the Applicants respectfully request the Examiner withdraw the obviousness rejection.

Also, Lordo, as shown in FIG. 6, is a toothless induction motor. The Japanese Reference is a permanent magnet motor. These motors operate on significantly different principles (for instance, the torque in the Lordo device is achieved through Eddy currents, which the Japanese Reference has no use for). One having ordinary skill in

HAYES SOLOWAY P.C.  
130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

the art would not look to combine the teachings of a permanent magnet motor and a toothless induction motor because the principles of each are so significantly different. Therefore, the Applicants submit there is more teaching in the art not to combine these references than there is teaching, disclosure, or suggestion in the art to combine these references.

As a result of at least the above mentioned, the Applicants respectfully submit that claim 3 is allowable and allowance is respectfully requested.

B. Claim 10

Dependent claim 10 reads:

The motor of claim 1, wherein the rotor is supported adjacent the stator by a gimbal mechanism ***connected to the output shaft*** and supported on the stator.

***(Emphasis Added)***

The Applicants respectfully submit that it is not the Applicants' burden to prove that no teaching, disclosure, or suggestion exists within the prior art that would lead one of ordinary skill to make the particular combination of elements, as claimed. Instead, the initial burden is upon the Patent Office to establish a prima facie case of obviousness. Such a prima facie showing includes an identification of a proper suggestion or motivation within the prior art to make the combination. Nevertheless, the Applicants have closely reviewed the references applied by the Office Action and have been unable to identify any teaching, disclosure, or suggestion contained within these references or elsewhere in the prior art that would lead one of ordinary skill in the art (without the benefit of

HAYES SOLOWAY P.C.  
130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

hindsight) to make the combination (both structure and function) as set forth in the claims of the present application.

Therefore, if the Examiner intends to maintain the obviousness rejections, based upon a combination of prior art references, the Applicants respectfully request that the Examiner identify the specific teaching, disclosure, or suggestion within the prior art that would suggest the desirability or motivation for the particular combination of elements as claimed.

The Applicants respectfully submit that the Japanese Reference in view of Lordo, fails to teach, disclose, or suggest combining the references to realize the invention of claim 10.

Specifically, the Examiner states that "it would have been obvious at the time the invention was made for one of ordinary skill in the art to have utilized a gimbal support mechanism in order to increase the degrees of freedom for the device." However, the Japanese Reference teaches a device capable of three degrees of freedom, which is no less than the degrees of freedom of the present invention. Therefore, utilizing a gimbal support mechanism in combination with the Japanese Reference would not have increased the degrees of freedom for the device and the motivation suggested by the Examiner is moot. Similarly, Lordo fails to teach, disclose, or suggest an output shaft, much less the compatibility of a gimbal mechanism with an output shaft. The references fail to teach, disclose, or suggest combining the gimbal mechanism of Lordo with the output shaft of the Japanese Reference.

HAYES SOLOWAY P.C.  
130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

As a result of at least the above mentioned, the Applicants respectfully submit that claim 10 is allowable and allowance is respectfully requested.

C. Claim 11

The Applicants respectfully submit that since claim 11 depends on dependent claim 10, claim 11 contains all of the limitations of dependent claim 10. Since dependent claim 10 should be allowed, as argued above, pending dependent claim 11 should be allowed as a matter of law for at least this reason. In re Fine, 5 USPQ 2d 1596, 1608 (Fed. Cir. 1988).

D. Claim 14

Independent claim 14 reads:

A motor having an output shaft movable in multiple degrees of freedom, the motor comprising:  
a stator, the stator having an interior surface and first and second stator coils wound in close proximity to the interior surface, the stator coils positioned substantially orthogonally to each other, the stator comprising a plurality of laminations, **the laminations radially disposed about a center point with a plane of each lamination extending through the center point; and**  
a rotor fixed to the output shaft and movably supported adjacent the stator with an air gap disposed between the rotor and the stator, the rotor including **at least one magnet disposed thereon and being movable along the interior surface in directions defining at least first and second degrees of freedom.**

***(Emphasis Added)***

The Applicants respectfully submit that the Japanese Reference, in view of Lordo, fails to teach, disclose, or suggest at least the above-emphasized element of claim 14.

HAYES SOLOWAY P.C.  
130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

Specifically, the Japanese Reference in view of Lordo fails to at least teach, disclose, or suggest the laminations radially disposed about a center point with a plane of each lamination extending through the center point. Lordo teaches laminations radially disposed about a center point, but fails to teach, disclose, or suggest that the plane of each lamination extends through the center point. As there is no teaching, disclosure, or suggestion in either the Japanese Reference or in Lordo to have the laminations radially disposed about a center point with a plane of each lamination extending through the center point to produce the claimed invention, the Applicants respectfully request the Examiner withdraw the obviousness rejection.

Also, the Japanese Reference in view of Lordo fails to at least teach, disclose, or suggest at least one magnet disposed [on the rotor] and being movable along the interior surface in directions defining at least first and second degrees of freedom. The Japanese Reference fails to teach, disclose, or suggest a magnet movable along the interior surface in directions defining at least first and second degrees of freedom. Lordo fails to disclose a magnet disposed on the rotor and fails to disclose a magnet movable along the interior surface in directions defining at least first and second degrees of freedom. As there is no teaching, disclosure, or suggestion in either the Japanese Reference or in Lordo to have at least one magnet disposed [on the rotor] and being movable along the interior surface in directions defining at least first and second degrees of freedom to produce the claimed invention, the Applicants respectfully request the Examiner withdraw the obviousness rejection.

HAYES SOLOWAY P.C.  
130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

As a result of at least the above mentioned, the Applicants respectfully submit that claim 14 is allowable and allowance is respectfully requested.

E. Claims 15-21

The Applicants respectfully submit that since claims 15-21 depend on independent claim 14, claims 15-21 contain all of the limitations of independent claim 14. Since independent claim 14 should be allowed, as argued above, pending dependent claims 15-21 should be allowed as a matter of law for at least this reason. In re Fine, 5 USPQ 2d 1596, 1608 (Fed. Cir. 1988).

1. Claim 16

Dependent claim 16 presently reads:

The motor of claim 14, wherein each lamination comprises ***an arcuate surface perpendicular to the plane of the lamination.***

***(Emphasis Added)***

The Applicants respectfully submit that the Japanese Reference, in view of Lordo, fails to teach, disclose, or suggest at least the above-emphasized element of claim 16.

Specifically, the Japanese Reference in view of Lordo fails to at least teach, disclose, or suggest an arcuate surface perpendicular to the plane of the lamination. The Examiner's argument on this point is "see Lordo et al. figure 4." That figure does not show any lamination with sufficient detail to at least teach, disclose, or suggest that a lamination have an arcuate surface perpendicular to the plane of lamination. As there is no teaching, disclosure,

or suggestion in either the Japanese Reference or in Lordo to have an arcuate surface perpendicular to the plane of the lamination to produce the claimed invention, the Applicants respectfully request the Examiner withdraw the obviousness rejection.

Also, Lordo is a toothless induction motor. The Japanese Reference is a permanent magnet motor. These motors operate on significantly different principles. One having ordinary skill in the art would not look to combine the teachings of a permanent magnet motor and a toothless induction motor because the principles of each are so significantly different. Therefore, the Applicants submit there is more teaching in the art not to combine these references than there is teaching, disclosure, or suggestion in the art to combine these references.

As a result of at least the above mentioned, the Applicants respectfully submit that claim 16 is allowable and allowance is respectfully requested.

F. Claim 12

Dependent claim 12 reads:

The motor of claim 1, wherein ***the output shaft is additionally an input shaft.***

***(Emphasis Added)***

The Applicants respectfully submit that it is not the Applicants' burden to prove that no teaching, disclosure, or suggestion exists within the prior art that would lead one of ordinary skill to make the particular combination of elements, as claimed. Instead, the initial burden is upon the Patent Office to establish a prima facie case of obviousness. Such a prima facie showing includes an



identification of a proper suggestion or motivation within the prior art to make the combination. Nevertheless, the Applicants have closely reviewed the references applied by the Office Action and have been unable to identify any teaching, disclosure, or suggestion contained within these references or elsewhere in the prior art that would lead one of ordinary skill in the art (without the benefit of hindsight) to make the combination (both structure and function) as set forth in the claims of the present application.

The Examiner has stated it would be obvious to combine the spherical motor of the Japanese Reference with the force feedback joystick of Marcus. However, the Japanese Reference does not teach, disclose, or suggest use as a force feedback joystick and Marcus does not teach, disclose, or suggest modifying a spherical motor to create a force feedback joystick. Also, the Japanese References only has one axis of force or torque, meaning the only input to be provided through the spherical motor of the Japanese Reference must be provided by rotating the rotor axially. The Applicants are not aware of any need in the art for an input shaft that is so strictly limited. Therefore, if the Examiner intends to maintain the obviousness rejections, based upon a combination of prior art references, the Applicants respectfully request that the Examiner identify the specific teachings or disclosure within the prior art that would suggest the desirability or motivation for the particular combination of elements as claimed.

As a result of at least the above mentioned, the Applicants respectfully submit that claim 12 is allowable and allowance is respectfully requested.

HAYES SOLOWAY P.C.  
130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

G. Claim 13

The Applicants respectfully submit that since claim 13 depends on dependent claim 12, claim 13 contains all of the limitations of dependent claim 12. Since dependent claim 12 should be allowed, as argued above, pending dependent claim 13 should be allowed as a matter of law for at least this reason. In re Fine, 5 USPQ 2d 1596, 1608 (Fed. Cir. 1988).

H. Claim 20

Dependent claim 20 presently reads:

The motor of claim 14, wherein ***the output shaft is additionally an input shaft.***

***(Emphasis Added)***

The Applicants respectfully submit that it is not the Applicants' burden to prove that no teaching, disclosure or suggestion exists within the prior art that would lead one of ordinary skill to make the particular combination of elements, as claimed. Instead, the initial burden is upon the Patent Office to establish a prima facie case of obviousness. Such a prima facie showing includes an identification of a proper suggestion or motivation within the prior art to make the combination. Nevertheless, the Applicants have closely reviewed the references applied by the Office Action and have been unable to identify any teaching, disclosure or suggestion contained within these references or elsewhere in the prior art that would lead one of ordinary skill in the art (without the benefit of hindsight) to make the combination (both structure and function) as set forth in the claims of the present application.

The Examiner has stated it would be obvious to combine the spherical motor of the Japanese Reference with the force feedback joystick of Marcus. However, the Japanese Reference does not teach, disclose, or suggest use as a force feedback joystick and Marcus does not teach, disclose, or suggest modifying a spherical motor to create a force feedback joystick. Also, the Japanese References only has one axis of force, meaning the only input to be provided through the spherical motor of the Japanese Reference must be provided by rotating the rotor axially. The Applicants are not aware of any need in the art for an input shaft that is so strictly limited. Therefore, if the Examiner intends to maintain the obviousness rejections, based upon a combination of prior art references, the Applicants respectfully request that the Examiner identify the specific teaching, disclosure or suggestion within the prior art that would suggest the desirability or motivation for the particular combination of elements as claimed.

As a result of at least the above mentioned, the Applicants respectfully submit that claim 20 is allowable and allowance is respectfully requested.

I. Claim 21

The Applicants respectfully submit that since claim 21 depends on dependent claim 20, claim 21 contains all of the limitations of dependent claim 20. Since dependent claim 20 should be allowed, as argued above, pending dependent claim 21 should be allowed as a matter of law for at least this reason. In re Fine, 5 USPQ 2d 1596, 1608 (Fed. Cir. 1988).

HAYES SOLOWAY P.C.  
130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

J. Claim 22

Independent Claim 22 presently reads:

A motor having an output shaft movable in multiple degrees of freedom, the motor comprising:

a first stator, the first stator having an interior curved surface and a first stator coil, a second stator coil, and a third stator coil, the stator coils wound in close proximity to the interior surface;

a second stator, the second stator having an interior curved surface and a fourth stator coil, a fifth stator coil, and a sixth stator coil, the stator coils wound in close proximity to the interior surface;

a commutation system capable of changing the distribution of current in the first, second, third, fourth, fifth, and sixth coils to provide a desired force at each output shaft position; and

a rotor ***fixed to the output shaft*** and movably supported adjacent the first stator and the second stator with an air gap disposed between the rotor and the stators, the rotor including ***at least one magnet disposed thereon and being movable along the interior surfaces*** in directions defining at least first, second, and third degrees of freedom, ***each degree of freedom substantially perpendicular to the other degrees of freedom, wherein energization of at least one of the stator coils is capable of urging the rotor along any of the degrees of freedom.***

***(Emphasis Added).***

The Applicants respectfully submit that the Japanese Reference in view of Lordo and further in view of Trumper, fails to teach, disclose, or suggest at least the above-emphasized elements of claim 22.

Specifically, the Japanese Reference in view of Lordo and further in view of Trumper, fails to at least teach, disclose, or suggest at least one magnet disposed on a rotor and moveable along an interior curved surface.

The Examiner's argument is silent on this point. The Japanese Reference moves a magnet mounted on a rotor between curved surfaces of a stator.

Lordo does not move a magnet in relation to the interior surface of a stator.

More specifically, Lordo does not have so much as a magnet to move.

Trumper moves magnets attached to a platform along a flat surface. None of the references teach, disclose, or suggest at least one magnet disposed on a rotor along a curved interior surface of a stator.

The Applicants respectfully submit that it is not the Applicants' burden to prove that no teaching, disclosure or suggestion exists within the prior art that would lead one of ordinary skill to make the particular combination of elements, as claimed. Instead, the initial burden is upon the Patent Office to establish a prima facie case of obviousness. Such a prima facie showing includes an identification of a proper suggestion or motivation within the prior art to make the combination. Nevertheless, the Applicants have closely reviewed the references applied by the Office Action and have been unable to identify any teaching, disclosure or suggestion contained within these references or elsewhere in the prior art that would lead one of ordinary skill in the art (without the benefit of hindsight) to make the combination (both structure and function) as set forth in the claims of the present application. Specifically, none of the references teach, disclose, or suggest disposing a magnet on a rotor and making that magnet moveable along a curved interior surface of a stator. As no such teaching, disclosure, or suggestion exists, the Applicants believe this rejection is overcome.

Further, none of the references teach, disclose, or suggest using multiple stators, as with Lordo, on a motor provided in the Japanese Reference. Lordo is a toothless induction motor, which is lacking both a magnet and an output shaft. The Japanese Reference is a permanent magnet motor. These motors operate on significantly different principles. One having ordinary

HAYES SOLOWAY P.C.  
130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

skill in the art would not look to combine the teachings of a permanent magnet motor and a toothless induction motor because the principles of each are so significantly different. A prima facie showing requires an identification of a proper suggestion or motivation within the prior art to make the combination. As no such teaching, disclosure, or suggestion exists, the Applicants believe this rejection is overcome.

As a result of at least the above mentioned, the Applicants respectfully submit that claim 22 is allowable and allowance is respectfully requested.

K. Claims 23-34

The Applicants respectfully submit that since claims 23-34 depend on independent claim 22, claims 23-34 contain all of the limitations of independent claim 22. Since independent claim 22 should be allowed, as argued above, pending dependent claims 23-34 should be allowed as a matter of law for at least this reason. In re Fine, 5 USPQ 2d 1596, 1608 (Fed. Cir. 1988).

1. Claim 24

Dependent claim 24 presently reads:

The motor of claim 23, wherein upon energization of one or more of the ***first, second, or third stator coils*** a first magnetic field is established to urge the rotor to rotate in a direction of the first degree of freedom, and upon energization of one or more of the ***fourth, fifth, or sixth stator coils*** a second magnetic field is established to urge the rotor to rotate in a direction of the second degree of freedom, the second degree of freedom substantially perpendicular to the first degree of freedom.

**(Emphasis added)**

The Examiner has preliminarily rejected this claim based on the X, Y, and Z-axes in Figure 4 of the Japanese Reference. Figure 4 does not show, as the Examiner mentioned in the office action, six stator coils. Therefore, Figure 4 cannot show three stator coils urging a rotor in one direction and three other stator coils urging the rotor in a substantially perpendicular direction. Further, the magnetic force disclosed in the Japanese Reference can only move the rotor in one degree of freedom, axially rotating in the z-axis. Therefore, the Japanese Reference cannot be said to have two magnetic fields capable of urging the rotor to rotate in two substantially perpendicular directions. As no such teaching, disclosure, or suggestion exists, the Applicants believe this rejection is overcome.

As a result of at least the above mentioned, the Applicants respectfully submit that claim 24 is allowable and allowance is respectfully requested.

## 2. Claim 25

Dependent claim 25 presently reads:

The motor of claim 22, wherein ***the output shaft is additionally an input shaft.***

**(Emphasis Added)**

The Applicants respectfully submit that it is not the Applicants' burden to prove that no teaching, disclosure or suggestion exists within the prior art that would lead one of ordinary skill to make the particular combination of elements, as claimed. Instead, the initial burden is upon the Patent Office to establish a prima facie case of obviousness. Such a prima facie showing includes an

identification of a proper suggestion or motivation within the prior art to make the combination. Nevertheless, the Applicants have closely reviewed the references applied by the Office Action and have been unable to identify any teaching, disclosure or suggestion contained within these references or elsewhere in the prior art that would lead one of ordinary skill in the art (without the benefit of hindsight) to make the combination (both structure and function) as set forth in the claims of the present application.

The Examiner has stated it would be obvious to combine the spherical motor of the Japanese Reference, as modified by Lordo and as further modified by Trumper, with the force feedback joystick of Marcus. However, the Japanese Reference does not teach, disclose, or suggest use as a force feedback joystick, Marcus does not teach, disclose, or suggest modifying a spherical motor to create a force feedback joystick and neither Lordo, nor Trumper teach, disclose, or suggest using a spherical motor in a force feedback joystick.

Also, the Japanese References only has one axis of force, meaning the only input to be provided through the spherical motor of the Japanese Reference must be provided by rotating the rotor axially. The Applicants are not aware of any need in the art for an input shaft that is so strictly limited. Lordo is a toothless induction motor and, therefore, it is unlikely someone would combine the Marcus reference with the toothless induction motor of the Lordo reference. Therefore, not only is this combination not taught, disclosed, or suggested, but also there are reasons known to those having ordinary skill in the art to not combine these references.

HAYES SOLOWAY P.C.  
130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567



If the Examiner intends to maintain the obviousness rejections, based upon a combination of prior art references, the Applicants respectfully request that the Examiner identify the specific teaching, disclosure or suggestion within the prior art that would suggest the desirability or motivation for the particular combination of elements as claimed.

The Examiner has also stated it would be obvious to combine the spherical motor of Miles with the force feedback joystick of Marcus. Again, Miles does not teach, disclose, or suggest use of the spherical motor as a force feedback joystick and Marcus does not teach, disclose, or suggest modifying a spherical motor to create a force feedback joystick

As a result of at least the above mentioned, the Applicants respectfully submit that claim 25 is allowable and allowance is respectfully requested.

3. Claim 26

The Applicants respectfully submit that since claim 26 depends on dependent claim 25, claim 26 contains all of the limitations of dependent claim 25. Since dependent claim 25 should be allowed, as argued above, pending dependent claim 26 should be allowed as a matter of law for at least this reason. In re Fine, 5 USPQ 2d 1596, 1608 (Fed. Cir. 1988).

4. Claim 27

Dependent claim 27 presently reads:

The motor of claim 22, wherein the first stator comprises ***a first plurality of parallel laminations*** and the second stator comprises ***a second plurality of parallel laminations***

positioned in an arc about a center point, ***the first plurality arranged perpendicular to the second plurality.***

(Emphasis Added)

The Examiner has rejected this claim based on Figure 1 and Figure 4 of Lordo. The Applicants find no teaching, disclosure, or suggestion from Figure 1 or Figure 4 that either the first or second plurality of laminations is parallel. The Applicants further submit, to the extent that anything regarding the relationship between laminations is shown, the laminations are nonparallel. Also, the Applicants can find no teaching, disclosure or suggestion from Figure 1 or Figure 4 that the first plurality and second plurality of laminations are perpendicular. As no such teaching, disclosure, or suggestion exists, the Applicants believe this rejection is overcome.

As a result of at least the above mentioned, the Applicants respectfully submit that claim 27 is allowable and allowance is respectfully requested.

#### 5. Claims 28-32

The Applicants respectfully submit that since claims 28-32 depend on dependent claim 27, claims 28-32 contain all of the limitations of dependent claim 27. Since dependent claim 27 should be allowed, as argued above, pending dependent claims 28-32 should be allowed as a matter of law for at least this reason. In re Fine, 5 USPQ 2d 1596, 1608 (Fed. Cir. 1988).

#### L. Claim 37

The Examiner rejected claim 37 as being unpatentable over Miles in view of Fanning et al. The Examiner alleges in the office action that Miles discloses

laminations with an arcuate surface orthogonal to a first side surface and having a plurality of slots as shown in Figure 3 and as described in column 4, lines 55-58. The Applicants have amended claim 35 to clarify the location of the claimed arcuate surface, which can be best seen in FIG. 15c of the application, marked as  $I_5$ . Nothing in Figure 3 of Miles teaches, discloses, or suggests any individual lamination sheets have the claimed arcuate surface. Column 4, lines 55-58, of Miles states the stator blocks are made of laminations of magnetically permeable material, but it does not teach, disclose, or suggest any surface of the laminations are arcuate. Miles fails to teach, disclose, or suggest an arcuate surface on a lamination as claimed.

Further, Fanning fails to teach, disclose, or suggest an arcuate surface on a lamination as claimed. Fanning teaches wedge-shaped spacers for positioning parallel lamination groups to form circles. Fanning has designed this arrangement in an attempt to avoid magnetic flux passing through the wedges. The Applicants prefer to create a magnetic flux path through the laminations. Therefore, Fanning needs wedge-shaped spacers to serve the purpose of diverting a magnetic flux path, contrary to the Applicants' invention.

As Miles in view of Fanning fails to teach, disclose, or suggest each and every limitation of claim 35, the Applicants respectfully request the Examiner withdraw the obviousness rejection.

M. Claim 42

Independent Claim 42 presently reads:

A ferromagnetic lamination for use in a stator,  
comprising: ***an arcuate surface orthogonal to a side surface;***  
***a plurality of uniform spreaders*** adjacent the arcuate surface;

and a plurality of radially extending slots ***extending from the spreaders*** away from the arcuate surface.

***(Emphasis Added).***

The Applicants respectfully submit that Lordo, in view of the Japanese Reference, fails to teach, disclose, or suggest at least the above-emphasized element of claim 42.

Specifically, Lordo in view of the Japanese Reference fails to at least teach, disclose, or suggest an arcuate surface orthogonal to a side surface. Lordo teaches laminations, but fails to teach, disclose or suggest each individual lamination has an arcuate surface that is orthogonal to a side surface. The Japanese Reference fails to teach, disclose, or suggest laminations. As there is no teaching, disclosure, or suggestion in either the Japanese Reference or in Lordo to have an arcuate surface that is orthogonal to a side surface on each lamination to produce the claimed invention, the Applicants respectfully request the Examiner withdraw the obviousness rejection.

Further, Lordo in view of the Japanese Reference fails to at least teach, disclose, or suggest a plurality of uniform spreaders. Lordo teaches laminations, but fails to teach, disclose, or suggest a plurality of spreaders. The Japanese Reference teaches spreaders, but fails to teach, disclose, or suggest laminations or uniformity of the spreaders. As there is no teaching, disclosure, or suggestion in either the Japanese Reference or in Lordo to have a plurality of uniform spreaders to produce the claimed invention, the Applicants respectfully request the Examiner withdraw the obviousness rejection.

N. Claims 46-51

In preliminarily rejecting claims 46-51, the Examiner stated, "these claims recite structural limitations of claim 25 and 33 while adding the word providing. The claim is a method of using the device of claims 25 and 33, and it is rejected over the same references." The Applicants respectfully submit that claims 25 and 33 are allowable for the reasons provided herein and, therefore, based on the same rationale for the Examiner's rejection of claims 46-51, the Applicants respectfully request the Examiner withdraw the rejection of claims 46-51 for the same reasons the Applicants requested the rejections of claims 25 and 33 be withdrawn.

IV. Allowable Subject Matter

The Examiner stated claims 7-9 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form, including all of the limitations of the base claim and any intervening claim. Claim 7 depends from claim 1, which the Applicants submit is allowable as discussed herein and claims 8 and 9 depend from claim 7. Therefore, the Applicants respectfully request the objection to claims 7-9 be withdrawn.

The Examiner stated claims 38-41 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form, including all of the limitations of the base claim and any intervening claim. Claim 38 is an independent claim from which claims 39-41 depend. The Applicants therefore submit that claim 38 and the claims that depend therefrom were object to in error and respectfully request the objection to claims 38-41 be withdrawn.

V. Non-Addressed Claims

The Examiner took no position on claims 43-45. Independent claim 43 contains many of the same limitations contained in claim 38 and the Applicants therefore submit that claim 43 at least contains similar allowable subject matter. Claims 44 and 45 depend from claim 43 and would therefore at least be allowable based on the allowability of claim 43. The Applicants therefore respectfully request that claims 43-45 be allowed.

VI. Prior Art Made of Record

The prior art made of record has been considered, but is not believed to affect the patentability of the presently pending claims.

VII. Conversation Regarding the Japanese Reference

The April 23, 2004 office action contains rejections based on the Japanese Reference, specifically based on the abstract and figures of the Japanese Reference. At the time the office action was mailed, the Examiner did not have a translation in his possession. However, on page 3 of the office action, the Examiner stated, "a translation of Japanese Reference '856 will be supplied in the next office action." The Applicants, not wanting to be disadvantaged by not having full access to a reference and not wanting to receive a final office action based on material that may be contained within the specification of the Japanese Reference, respectfully asked the Examiner to amend the start of the three-month statutory period until the translation could be provided. The Examiner stated he was not empowered to

amend the start of the shortened statutory period, but kindly agreed that the next office action (if necessary) would not be a final office action. Further, in this regard, the Applicants request the Examiner mail a copy of the Japanese Reference with the next action, as the characters in the equations and figures for the Japanese Reference are largely illegible in the fax copy received.

**HAYES SOLOWAY P.C.**

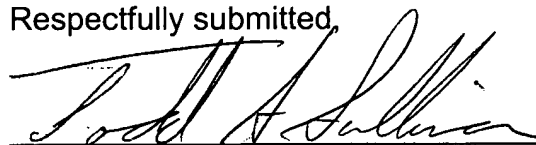
130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

CONCLUSION

In light of the foregoing amendments and for at least the reasons set forth above, the Applicants respectfully submit that all objections and rejections have been traversed, rendered moot and/or accommodated, and that presently pending claims 1-51 are in condition for allowance. Favorable reconsideration and allowance of the present application and the presently pending claims are hereby courteously requested. If in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (603) 668-1400.

Respectfully submitted,



Todd A. Sullivan  
Attorney for Applicant  
Reg. No. 47,117

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner of Patents and Trademarks, P.O. Box 1450, Alexandria, VA 22313-1450 on September 23, 2004 at Manchester, New Hampshire.

By: Kristine Stevens

HAYES SOLOWAY P.C.

130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567